SUMMARY OF 2001 MASSACHUSETTS PIPING PLOVER CENSUS DATA

Photo by Bill Byrne

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ABSTRACT

This report presents the results of Piping Plover (*Charadrius melodus*) monitoring and management efforts conducted in Massachusetts in 2001. Observers reported plovers nesting at 103 sites; 58 additional sites were monitored but no breeding pairs were detected. The Index Count (conducted during a standardized nine-day period) was 481 pairs, and the Adjusted Total Count (estimated total number of breeding pairs during the entire season) was 495 pairs. Overall productivity for 494 of 495 pairs (99.8%) was 1.49 chicks fledged per pair. Of 559 nests, 62% hatched $\geq$ 1 egg, 61% of eggs hatched, and 56% of chicks fledged. The two most common causes of nest loss were predation and abandonment. Mortality of adult plovers was the primary suspected cause of nest abandonment: twenty adult plovers were found dead during the season. Exclosed nests were abandoned more frequently than were unexclosed nests (19% vs. 4%); however, nest success was higher for exclosed nests than for unexclosed nests (75% vs. 41%). The most frequently identified nest predators were crows, followed by skunks, foxes, and gulls.

INTRODUCTION

The Piping Plover (*Charadrius melodus*) is a small, sand-colored shorebird that nests on sandy coastal beaches and dunes. The Atlantic Coast population of the Piping Plover has been federally listed as "Threatened" since 1986. The species is also listed by the Massachusetts Division of Fisheries and Wildlife as "Threatened" pursuant to Massachusetts' Endangered Species Act. Currently, major threats to the Piping Plover are mammalian and avian predation, habitat degradation, and disturbance and direct mortality of eggs and chicks caused by beach-users and off-road vehicles (Hecht et al. 1996). In this report, we detail the results of the 2001 season of Piping Plover monitoring and management by an extensive network of cooperators throughout Massachusetts. Specifically, we report on abundance, distribution, breeding performance, and causes of nest loss and chick and adult mortality.

METHODS

Monitoring and management of Piping Plovers and other coastal waterbirds in Massachusetts is carried out by a coast-wide group of cooperators composed of full-time and seasonal biologists, beach managers, researchers, and volunteers. Data summarized in this report were contributed by over 90 individuals. Cooperators monitored 161 sites in Massachusetts in 2001 for the presence of breeding Piping Plovers.

Abundance

We measure abundance of Piping Plovers in Massachusetts in terms of breeding pairs, defined as pairs observed with either a nest or unfledged chicks or that exhibit site tenacity and evidence of pair bonding and territoriality for at least two weeks. We report three different measures of abundance: the *Index Count, Unadjusted Total Count,* and *Adjusted Total Count.* The *Index Count*, as reported since 1990, is the total number of pairs tallied statewide each year during a nine-day count period in late May and early June, standardized each year for the entire Atlantic Coast. In 2001, the *Index Count* period was 26 May to 3 June. The objective of the *Index Count* is to estimate population size with a minimum of double-counting of pairs that move between or within sites, thereby

providing an index to population trends that is likely more precise than counts based on observations made over longer periods of the breeding season. We believe the *Index Count* minimizes double-counting because it occurs over such a short period of time. However, we also recognize that it probably consistently underestimates actual breeding population size, because it does not include pairs that leave the state before the count period, arrive after the count, or simply go undetected during the nine-day count period.

Starting with the 2000 census, we have reported two different "Total Counts". The *Unadjusted Total Count* is a simple tally of the total number of pairs reported for all sites by all observers over the course of the entire nesting season, with limited effort made to adjust for pairs that may have been double-counted if they nested unsuccessfully at one location and then renested at another. We then derived an *Adjusted Total Count* by calculating the average of the *Index Count* and the *Unadjusted Total Count*, rounded to the nearest whole number of pairs. The *Unadjusted Total Count* is simple and relatively objective to calculate, but undoubtedly overestimates the actual population by double-counting pairs that establish nesting territories at more than one location in a given year. Without color-banded birds, it is impossible to accurately and objectively determine which birds nest at multiple locations within a breeding season or simply do not arrive or begin breeding activities until June. It has become too time-consuming, subjective, and, we suspect, inaccurate to try and adjust the total count of pairs each year by not tallying late-nesting pairs (*i.e.*, pairs reported as "new" pairs that nested after the first week in June), based on the assumption that these birds were probably already counted earlier in the season. We suspect that the *Adjusted Total Count* is the most accurate estimate of the actual number of breeding pairs in Massachusetts because it falls midway between the *Index Count* and *Unadjusted Total Count*, which we believe underestimate and overestimate, respectively, the actual breeding population. We calculated the *Index Count*, *Unadjusted Total Count*, and *Adjusted Total Count* for the entire state, and also separately for each region within the state.

Reproductive success

The primary measure of reproductive success that we report is *productivity*, measured as number of chicks fledged per pair. The denominator of this ratio is the number of breeding pairs for which fledging data are reported; this includes not only pairs that successfully fledged chicks, but also all pairs for which it can be confidently determined that they fledged no chicks, either because they failed to nest, nested unsuccessfully (*i.e.*, no eggs hatched), or none of their chicks survived to fledge. Since the 2000 census, we have reported two different "Numbers of pairs with fledge data." As for counts of breeding pairs, estimates of pairs for which fledging data are reported will be biased if any double-counting of pairs occurs. Double-counting will overestimate the number of pairs in the denominator of the productivity ratio, and thereby will underestimate actual productivity. To reduce the potential bias associated with double-counting, we multiplied the *Unadjusted number of pairs with fledge data* (a tally of the total number of pairs with fledge data reported for all sites, with no attempt made to adjust for pairs that may have been double-counted) by the ratio of the *Adjusted Total Count* to the *Unadjusted Total Count* to arrive at the *Adjusted number of pairs with fledge data*. We used this method to calculate productivity for the entire state, and also separately for specific regions of the state, unless examination of the count data revealed no pairs that were likely to have been double-counted (*i.e.*, pairs that nested unsuccessfully and left a territory before or during the first week in June, or were reported as new pairs after the first week of June).

We also report the following measures of reproductive success for the entire state: *observed nest success* (percentage of nests that hatched $\geq$ 1 egg), *observed hatching success* (percentage of eggs that hatched), and *observed fledging success* (percentage of chicks that survived to 25 days of age or were able to fly $\geq$ 50 feet, whichever occurred first).

Data reporting and quality control

All data were reported by cooperators who filled out a standard Massachusetts Piping Plover Census Form for each site visited. This form requests data on number of breeding pairs (*Index Count* and *Total Count*); frequency of site visits; exclosure design and installation date; dates of nest discovery, completion, hatching, and failure; number of eggs when the nest was discovered; total numbers of eggs laid, eggs hatched, and chicks fledged; reasons for egg and chick loss; and general comments and management needs. Maps of sites showing the locations of all nests were also requested.

Upon receipt of forms, we contacted cooperators to obtain missing data, resolve inconsistencies, and clarify ambiguities. Unsuccessful nests were then assigned to one of several categories of nest failure: predation (*e.g.*, by fox, skunk, crow, gull, other, or unknown predator); flooding/overwash; abandonment (*e.g.*, due to egg inviability, inclement weather, disturbance, harrassment, adult disappearance/death, other, multiple causes, or unknown); unknown; or other (*e.g.*, vandalism, inviable eggs removed by monitor).

RESULTS AND DISCUSSION

Abundance

Observers reported breeding Piping Plovers at 103 sites in Massachusetts during the 2001 breeding season. An additional 58 sites were monitored one or more times during May and June, but no breeding pairs were detected (Table 1). More sites were monitored for the presence of Piping Plovers in 2001 (161 sites) than in 2000 (140) (Mostello and Melvin 2001); however, the additional sites monitored in 2001 are marginal sites that are usually unoccupied by plovers. Indeed, just two additional pairs were detected by monitoring these locations.

The 2001 Index Count was 481 pairs, the Unadjusted Total Count was 509.5 pairs, and the Adjusted Total Count was 495 pairs (Table 1). The Index Count was 97% of the Adjusted Total Count, and a slight (0.6%) decrease from the 2000 Index Count of 484 pairs (Fig. 1) (Mostello and Melvin 2001). The Adjusted Total Count of 495 pairs in 2001 was nearly identical to the Adjusted Total Count of 496 pairs in 2000.

Three regions harbored 69% of the total pairs breeding in the state: the Lower Cape (38%), the Upper Cape (21%), and Martha's Vineyard (10%) (Fig. 2). Sites with the largest number of breeding pairs were South Beach in Chatham (32), Crane Beach in Ipswich (28.5 pairs), South Monomoy Island in Chatham (27), and Sandy Neck in Barnstable (26). Crane Beach was formerly the site with the largest number of breeding plovers in the state (46 pairs in 2000; Mostello and Melvin 2001); however, serious problems with predation on adults may have caused the sudden drop in numbers of pairs (see "Causes of mortality" below). Fifteen sites reported $\geq$ 10 pairs, and collectively they accounted for 55% of all pairs. At the other end of the size spectrum, 62 sites with $\leq$ 3 pairs collectively supported 21% of the state's Piping Plover population.

Reproductive success

Overall observed nest success was 0.62 (368 of 593 nests hatched $\geq$ 1 egg). For nests protected with exclosures, nest success was 0.75, as compared to only 0.41 for nests without exclosures (Table 2). For 559 nests for which complete data were reported, observed hatching success was 0.61 (1,252 of 2,068 eggs hatched). Seventy-one percent of eggs protected with exclosures hatched compared to only 40% of unprotected eggs (Table 3). Fledging success was 0.56 (701 of 1,252 chicks survived to fledge). Values for hatching and fledging success were markedly higher than 2000 values, which were the lowest recorded since these parameters were first calculated in 1992 (Fig. 3) (Mostello and Melvin 2001).

During the 2001 nesting season, overall mean productivity was 1.49 chicks fledged per pair based on data from an estimated 494 of 495 pairs (99.8%) (Figs. 1 and 3). This is a

substantial improvement over last year's productivity of 1.09 chicks fledged per pair (Mostello and Melvin 2001). In 2001, five of eight regions of the state averaged > 1.5 chicks per pair, and only two (Martha's Vineyard and Nantucket) averaged < 1.0 chicks per pair (Fig. 4). In 2000, only two regions of the state averaged > 1.5 chicks per pair, and two regions averaged < 1.0 chicks per pair.

In 2001, the most common cause of nest loss was predation, followed by abandonment (Table 4). The most frequently identified nest predators were crows, followed by skunks, foxes, and gulls. Causes of nest abandonment were reported as unknown in 30 of 80 instances (38%) (Table 5). The most commonly suspected causes of nest abandonment were death of one of the adults (24 nests; 18 confirmed and 6 suspected) and harassment by predators (8 nests). Only 15 nests (3%) were lost to flooding in 2001, compared to 178 (23%) in 2000 (Mostello and Melvin 2001). Wire predator exclosures were used to protect 390 of 593 nests (66%). Excluding nests lost to flooding, 19% of nests in exclosures were abandoned (73 of 384 nests) compared to only 4% of nests without exclosures (7 of 194 nests).

Causes of mortality

Chicks. Few causes of chick mortality were directly observed. At Third Cliff, a 6 day-old chick was found dead in a human footprint; however, it is possible that inclement weather caused the mortality. A 16 day-old chick was run over by an ORV at Duxbury Beach. Three young chicks at Ellisville were abandoned by their parents after fox harassment at the exclosure. At Springhill Beach, a chick that was unable to walk lived just one day. A chick at Scorton (Neck) Creek died at hatching. At Sandy Neck, a 5 day-old chick was run over by a vehicle. An observer at Dowses Beach saw a fight between two crows and a plover pair, after which a crow flew off with what appeared to have been a newly hatched plover chick in its bill. Four newly hatched chicks at Kalmus Park died after the adult(s) would not brood them. A chick that appeared to have a damaged leg and wing on one side disappeared from Tern Island. At Barney's Joy, adults abandoned a nest just before two chicks hatched; they hatched unattended and died from neglect. A chick at Arruda's Point/Jetties was found dead, probably from exposure. At Dogfish Bar, an approximately 3 week-old chick with a wound on its breast died. At Smith Point, Northern Harriers were seen capturing plover chicks, and were probably responsible for deaths of 8 chicks (2 broods, ages 4 and 10 days).

Adults. Observers reported a total of twenty adult Piping Plovers found dead in Massachusetts in 2001, the most reported since we began keeping records in the mid-1980s. Previously, the greatest number of adults found dead was eleven in 2000 (Mostello and Melvin 2001). These mortalities occurred at: Crane Beach (eight), South Beach, Chatham (six, and six more suspected), Smith Point (three), Parker River NWR (one), Joseph Sylvia State Beach (one), and Kalmus Park (one). All but one of the twenty confirmed deaths occurred at exclosed nests, and eighteen deaths were suspected caused by avian predators. At Crane Beach, a Great Horned Owl feather was found at one kill site, and owls were suspected to be responsible for six other adult deaths. At one of these nests, the remaining adult managed to fledge four chicks. Another adult death at an unexclosed nest may have been caused by a coyote. At South Beach, it appeared that avian predators were responsible for six adult deaths; six other abandonments in the same time period may have been due to undiscovered adult mortalities. A Northern Harrier

was suspected for most of the deaths, but gulls may also have caused some mortality. At Smith Point, deaths of adults at three nests were probably due to crows; crow tracks were present at all three exclosures. It should be noted, however, that a Northern Harrier was preying on plover chicks at this site. A crow at Parker River NWR was suspected to be responsible for the death of an adult. Crows may also have caused an adult death at Joseph Sylvia State Beach. The design of the exclosure, however, may have been a contributing factor: the 2" chicken wire used may have been too small to allow for quick passage of adults through the exclosure. At Kalmus Park, an adult died after becoming caught in the exclosure netting; there was no evidence of predation or other trauma.

Renesting following brood loss

Piping Plovers normally do not renest after losing chicks. In 2001, observers reported a fairly high number of instances (seven) of renesting by pairs that lost chicks, although without banded birds, it is impossible to determine with certainty whether or not successive nests were, in fact, from the same pair. This behavior was reported from Third Cliff, Springhill Beach, Sampson's I.-Dead Neck, Dowses Beach, Long Beach (Centerville), Barney's Joy, and Black Point Pond. Ages of the chicks when lost ranged from zero to twelve days old. At Barney's Joy, the adults had actually abandoned the nest just prior to its hatching.

ACKNOWLEDGEMENTS

We extend our sincere thanks to the many biologists, seasonal staff, beach managers, landowners, and volunteers that participated in conservation efforts on behalf of Piping Plovers and other coastal waterbirds in Massachusetts in 2001. This work was carried out by cooperators from over 30 state and federal agencies, local municipalities and county governments, private conservation groups, and universities. We especially thank all the individuals who participated in population monitoring and submitted the data that are summarized in this report.

LITERATURE CITED

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Table 1. Abundance, distribution, and productivity of Piping Plovers in Massachusetts, 2001.

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
NORTH SHORE					
Salisbury Beach, Salisbury	0	nd[e]	nd	nd	SvO
Salisbury Bch. St. Res., Salisbury	0	nd	nd	nd	SvO
Plum Island-North End, Newburyport/Newbury	0	0	0	0	DM, LMc
Parker River NWR, Newbury/Rowley	11	13	26	13	DM, LMc
Sandy Point State Res., Ipswich	3	4	0	4	DM, LMc
Crane Beach, Ipswich	27	28.5[f]	34	28.5[f]	WC, FI, DW, LC
Coffin's Beach, Gloucester	0	1	0	1	MZ
Wingaersheek Beach, Gloucester	0	nd	nd	nd	DR, MZ
Good Harbor Beach, Gloucester	0	nd	nd	nd	MZ
SOUTH SHORE					
Third Cliff, Scituate	3	4	8	4	ESh, MZ
Fourth Cliff, Scituate	1	1	2	1	ESh, MZ
Rexhame Beach, Marshfield	1	1	3	1	ESh, MZ
Duxbury Beach, Duxbury/Plymouth	8	9	17	9	SHo
Saquish Beach, Plymouth[g]	0	0	0	0	SHo
Plymouth Beach, Plymouth	14	14	20	14	OM, MC
Ellisville, Plymouth[h]	2	3	1	3	MZ
Sagamore Beach, Bourne and Sandwich	3	3	3	3	LS, MZ
Scusset Beach State Res., Sandwich	2	2	1	2	LS, MZ
UPPER CAPE					
Mashnee Dike, Bourne	2	2	0	2	LS, MZ
Bassetts Island, Bourne	0	nd	nd	nd	MZ
Black Bch./Sippewisset, W. Falmouth	0	nd	nd	nd	MB

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
Woodneck Beach, W. Falmouth	0	nd	nd	nd	MB
Washburn Island, Falmouth[i]	5	5	3	5	MS
South Cape Beach, Mashpee	5	5	7	5	MS
New Seabury, Mashpee	3	3	3	3	MS
Rock Landing/Maushop Village, Mashpee	0	nd	nd	nd	MB
Popponesset Spit, Mashpee	3	3	8	3	BPi
Town Neck Beach, Sandwich	2	2	4	2	EP, KM, MB
Springhill Beach, Sandwich	11	11	18	11	EP, KM, MB
East Sandwich Beach, Sandwich	1	1	4	1	EP, MB
Scorton (Neck) Creek, Sandwich	3	3	7	3	EP
Scorton Shores, Sandwich	3	3	8	3	EP, MJa, RK, KW
Sandy Neck, Barnstable	23	26	43	26	MJa, RK, KW
Sampson's Is.-Dead Neck, Barnstable	11	11	18	11	MR, JD
Bone Hill Road, Barnstable	0	0	0	0	MB
Dowse's Beach, Osterville	1	1	0	1	JD, MR
Long Beach, Centerville	4	4	5	4	CB
Squaw Island, Hyannisport	3	3	2	3	CB, MB
Kalmus Park Beach, Hyannis	6	6	4	6	CB, MB
Gray's Beach, Yarmouth	2	2	1	2	MB
Seagull Beach/Radio City, Yarmouth[j]	2	2	5	2	BH, EM, MB
Great Island, Yarmouth	4	4	5	4	EM, BH, MB
Bass River Beach, Yarmouth	0	0	0	0	BH
West Dennis Beach, Dennis	3	4	8	4	JI
Chapin Beach, Dennis	1	1	0	1	JI
Mayflower Beach, Dennis	0	0	0	0	JI
Howes St. Beach, Dennis	0	1	0	1	JI
Town Landings, Dennis	nd	nd	nd	nd	-

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
Corporation Beach, Dennis	0	nd	nd	nd	JI
Sesuit Beach, Dennis	0	nd	nd	nd	JI
Quivett Neck/Coles Pond, Dennis	1	1	0	1	JI
Wings Island, Brewster	0	nd	nd	nd	PT
Paine's Creek, Brewster	0	0	0	0	FA, CA
Robbins Hill Beach, Brewster	0	nd	nd	nd	CM, BW
Town Beach, Brewster	0	nd	nd	nd	CM, BW
Ellis Launching Beach, Brewster	0	nd	nd	nd	CM, BW
Linell Landing Beach, Brewster	0	nd	nd	nd	CM, BW
Crosby's Landing Beach, Brewster	0	nd	nd	nd	CM, BW
Merkel Beach/Wychmere, Harwichport	2	2	3	2	KS
Red River Beach, Harwich	0	nd	nd	nd	MB
LOWER CAPE					
Forest Beach, Chatham	1	1	1	1	MB, KS
Cockle Cove/Ridgevale Beach, Chatham	1	1	0	1	KS
Harding Beach, Chatham	4	4	8	4	KS
Harding Beach Point, Chatham	nd	nd	nd	nd	-
North Monomoy Island, Chatham	2	2	4	2	SF
South Monomoy Island, Chatham	26	27	51	27	SF
South Beach, Chatham	31	32	43	32	MJ, HB, LF
Tern Island, Chatham	2	2	3	2	MJ, HB
Nauset Beach, Chatham	11	11	6	11	WL, JP
Nauset Beach, Orleans	5	6	9	6	CD
Nauset Spit (Heights), Orleans	14	14	23	14	CD
New Island, Orleans	0	0	0	0	MH
Skaket Beach, Orleans	nd	nd	nd	nd	-

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
Rock Creek (north side), Orleans	nd	nd	nd	nd	-
First Encounter Beach, Eastham	nd	nd	nd	nd	-
Coast Guard Beach, Eastham	13	14	16	14	MH
Marconi Beach/LeCount Hollow, Wellfleet	7	7	16	7	MH
Sunken Meadow Spit, Wellfleet	2	2	4	2	JDc, JB, JBl, JS
Lieutenant's Island, Wellfleet	1	1	4	1	JDc, FS, HS, PD, JS
Indian Neck, Wellfleet	0	0	0	0	JDc, JS
Jeremy Point/Great Island, Wellfleet	17	17	23	17	MH
Duck Harbor, Wellfleet[k]	1	1	2	1	MH
Bound Brook, Wellfleet[k]	1	1	4	1	MH
Pamet Harbor-South, Truro	0	0	0	0	MB, PD
Pamet Harbor-North/Corn Hill Beach, Truro	2	3	4	3	PD, MB
Pond Village Beach, Truro	0	nd	nd	nd	PD, SM
Pilgrim Beach/Beach Point, Truro	7	7	14	7	PD, MB
Ballston Beach/Newcomb Hollow, Truro	4	4	12	4	ES, JO
Longnook Beach, Truro	0	0	0	0	ES, JO
High Head/Head of the Meadow/Highland Beach, Truro	3	3	12	3	ES, JO
Race Point-South Beach, Provincetown/Truro	13	14	31	14	ES, JO
Race Point-North Beach, Provincetown	7	7	19	7	ES, JO
Long Point/Wood End, Provincetown	8	8	20	8	ES, JO
BRISTOL COUNTY					
Stony Point Dike, Wareham	2	3	3	3	LS, MZ
Long Beach Point, Wareham	0	nd	nd	nd	MZ
Little Harbor Beach, Wareham	0	nd	nd	nd	MZ
Strawberry Point, Mattapoisett	0	0	0	0	JHa

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
West Island, Fairhaven	0	0	0	0	JBo, SS, NC, MG
Winsegansett Heights, Fairhaven	0	0	0	0	JBo, SS, NC, MG
Round Hill Beach, Dartmouth	0	0	0	0	JBo, SS, NC, MG
Salters Pond, Dartmouth	0	0	0	0	JBo, SS, NC, MG
Demarest Lloyd State Park, Dartmouth	2	2	6	2	JBo, SS, MG, NC
Little Beach/Barney's Joy, Dartmouth	10	10	9	10	JBo, SS, NC, MG
Gooseberry Neck, Westport	1	1	2	1	JBo, SS, NC, MG
Horseneck Beach, Westport	13	14	29	14	JBo, SS, MG, NC
Acoaxet, Westport	0	0	0	0	CS
Cockeast Pond, Westport	1	1	1	1	ST, CS
Richmond Pond, Westport	1	1	1	1	ST, CS
Bay Point, Swansea	0	0	0	0	BB
ELIZABETH ISLANDS					
Naushon Island	1	1	4	1	JHa, SSt
Pasque Island-Robinson's Hole	0	nd	nd	nd	JHa
Pasque Island-Cobbly	0	nd	nd	nd	JHa
Pasque Island-Quick's Hole	0	nd	nd	nd	JHa
Nashawena Island-Quick's Hole	3	3	0	3	CE
Nashawena Island-Canapitsit	0	nd	nd	nd	JHa
Cuttyhunk Island	1	1	4	1	SM, JLun
Penikese Island	0	0	0	0	CAu, CM, HZ
MARTHA'S VINEYARD					
Eastville Point Beach, Oak Bluffs	1	1	1	1	SJ, RCu
Harthaven, Oak Bluffs	1	1[l]	4	1[l]	DS, SJ
Sylvia State Beach, Edgartown	3[m]	7[l]	6	7[l]	RCu, SJ, ND, DS

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
Cow Bay, Edgartown	0	0	0	0	SJ
Eel Pond/Little Beach/Lighthouse Beach, Edgartown	2	2	0	2	DS, LJ
Chappaquiddick Beach, Chappaquiddick	0	0	0	0	LJ, JR
Cape Pogue Elbow/The Narrows, Chappaquiddick	2	2	1	2	KC, GP, LR
Little Neck, Edgartown[n]	1	1	0	1	KC
Arruda's Pt./The Jetties, Chappaquiddick	1	1	0	1	KC, LR
Leland/East Beaches, Chappaquiddick	2	2	2	2	KC
Wasque, Chappaquiddick	0	1[o]	0	1[o]	KC
Norton Point Beach, Edgartown	9	9[o]	4	9[o]	RCu, SJ, ND, DS, LJ
South Beach, Edgartown	0	nd	nd	nd	SJ
Edgartown Great Pond/Job's Neck, Crackatuxet Pd., Edgartown	4	4	2	4	DS, JR, LJ, AS, DH
Oyster and Paqua Ponds, Edgartown	1	1[p]	0	1[p]	DS, LJ
Watcha Pond, W. Tisbury	0	1[p]	1	1[p]	DS, LJ
Tisbury Great Pond/Black Point Pond/Quansoo/Long Point, Chilmark[q]	2	2	3	2	DS, LJ, AS, CBl, CE
Chilmark Pond, Chilmark	1	1	4	1	DS, AS, JR, RG
Lucy Vincent Beach, Chilmark	1	1	0	1	RCu, DS
Long Beach/Squibnocket Beach, Chilmark	4	5	3	5	DS, LJ, AS
Menemsha Beach, Menemsha	0	0	0	0	DS
Moshup Trail Beach/Philbin Beach, Aquinnah	1	1	3	1	DS, AS, JR, RG, DG, JM
Dogfish Bar, Aquinnah	6	6	3	6	DS, AS
Lobsterville Beach, Aquinnah	0	0	0	0	DS, AS
Cedar Tree Neck/Lambert's Cove, West Tisbury	0	0	0	0	DS
Great Rock Bight Preserve	0	0	0	0	JR, CSy, DG, LH
Sepiessa Point Reservation	0	0	0	0	JR, JBr
Tashmoo, Tisbury	1	2	0	2	CB, DS
Wilfred's Pd. and Mink Meadows Beach, Vineyard Haven	3	3	4	3	DS, CB, JR, DG

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
Northern Pines Shores, Vineyard Haven	nd	nd	nd	nd	-
Nomans Land	0	0	0	0	SKo
NANTUCKET					
Great Point	5	5	2	5	AW, JG, LR
The Galls	1	1	0	1	AW, JG, LR
Coskata-West Beach[r]	0	0	0	0	AW, JG, LR
Coskata-Inner Trail[s]	0	0	0	0	AW, JG, LR
Coatue	0	0	0	0	KCB, JL
Coskata-East Beach[s]	0	0	0	0	AW, JG, LR
Coskata Inlet/The Haulover[s]	0	1	0	1	AW, JG, KCB
Wauwinet	1	1	nd	0	SA
Squam Pond	1	1	0	1	KCB, JL, SA
Quidnet/Sesachacha Pond	1	1	0	1	SA
Low Beach/Tom Nevers[t, u]	6	6	23	6	VT, LaM, BP
Surfside	0	nd	nd	nd	SA
Hummock Pond	1	1	0	1	KCB, JL
Smith Point	8	9	0	9	VT, LaM, AB, BBi
Eel Point	3	3	1	3	KCB, JL
Dionis Beach	0	0	0	0	VT
Quaise Point	0	0	0	0	VT
Tuckernuck Island	7	7	7	7	RV, SA
Muskeget Island	7	7	3	7	RV, SA

Location	Number of pairs		No. chicks fledged[c]	No. pairs with fledge data[c]	Source[d]
	Index Count[a]	Total Count[b]			
UNADJUSTED TOTALS	481	509.5[v]	736	508.5[w]	
ADJUSTED TOTALS	-	495[x]	-	494[y]	

[a] Index Count = number of territorial pairs counted between 26 May and 3 June, 2001, the standardized Index Count period for the Atlantic Coast population.

[b] Total Count = total number of territorial pairs present during all or a portion of the breeding season.

[c] Chicks fledged are defined as chicks $\geq$ 25 days of age or observed in flight, whichever occurs first. Number of pairs with fledge data includes all pairs for which it was determined how many chicks fledged; includes pairs that did not nest, pairs that nested unsuccessfully, and pairs with broods from which no chicks fledged.

[d] Key to sources: AB = Amanda Bixby, AS = Alexis Schoppe, AW = Andrew Webbe, BB = Brad Blodget, BBi = Bevin Bixby, BH = Bridget Haimel, BP = Bruce Perry, BPi = Bret Pilgrim, BW = Brad Wetherbee, CA = Carol Anderson, CAu = Christina Aucoin, CB = Christina Bartoli, CBl = Catherine Blonowicz, CD = Cathy Davis, CE = Chris Egan, CM = Carolyn Mostello, CS = Cheryl Swinconeck, CSy = Carol Sylvia, DG = Dick Gleason, DH = Devin Herrick, DM = Deborah Melvin, DR = David Rimmer, DS = Debra Swanson, DW = Don Wardwell, EM = Erin McCreless, EP = Elyse Peterson, ES = Eric Schneider, ESh = Erin Shupenis, FA = Fred Anderson, FI = Franz Ingelfinger, FS = Fred Streams, GB = Grier Potter, HB = Holly Busse, HS = Hazel Streams, HZ = Heather Ziel, JB = Judy Brainerd, JBl = John Blake, JBo = Jamie Bogart, JBr = Jeremiah Bresnahan, JD = James Dwyer, JDc = Jennifer DeCecco, JG = Jennifer Gundy, JHa = Jeremy Hatch, JI = Joe Iafrate, JL = Jerome Light, Jr. , JLun = Julie Lundgren, JO = John O'Neill, JP = James Patterson, JR = Julie Russell, JS = Jackie Sones, KC = Kate Condé, KCB = Karen Combs-Beattie, KM = Kristin Mena, KS = Katlyn Stillings, KW = Keith Williams, LaM= Larry Miller, LC = Lee Curtis, LF = Lisa Fitzgerald, LH = Leif Hopkins, LJ = Luanne Johnson, LMc = Lauren McCubbin, LR = Lloyd Raleigh, LS = Lillian Stone, MB = Matt Bailey, MC = Michael Comforti, MG = Megan Garretson, MH = Mary Hake, MJ = Martha Jason, MJa = Matt James, MR = Melissa Rose, MS = Megan Schlesinger, MZ = Margo Zdravkovic, NC = Nate Chester, ND = Nathan Durawa, OM = Owen Muise, PD = Phaedra Demers, PT = Peter Trull, RCu = Robert Culbert, RG = Robin Guest, RK = Russ Keyes, RV = Richard Veit, SA = Sasha Auer, SF = Sharon Fish, SHo = Sharyn Hood, SJ = Susan Jones, SKo = Stephanie Koch, SM = Scott Melvin, SS = Sara Sampieri, SSt = Sarah Storer, ST = Scott Tedford, SvO = Susi von Oettingen, VT = Vincent Todd, WC = Wayne Castonguay, WL = Wayne Love

[e] nd = no data available

[f] At Crane Beach, three individuals that paired with adults whose mates were killed were tallied as an extra 1.5 pairs.

[g] Saquish Beach was considered part of Duxbury Beach in all previous reports.

[h] Ellisville includes both Ellisville State Park and the private beach along the south side of Ellisville Harbor.

[i] The Washburn Island site included a small sand island (Gull Island) adjacent to the western tip of the ocean-facing beach.

[j] Although no plovers nested on Radio City Beach in 2001, a pair with chicks did move east from the Great Island causeway and foraged there.

[k] Bound Brook and Duck Harbor, Wellfleet were considered part of Great Island in all previous reports.

[l] Observers suspected that one pair that failed at Sylvia State Beach prior to the Index Count moved to Harthaven and renested. This pair is tallied for both sites, but only once in regional and state total counts and numbers of pairs with fledge data.

[m] One adult from one of the pairs at Sylvia State Beach was found dead inside an exclosure prior to the Index Count period.

[n] Little Neck was a new nesting site in 2001.

[o] Observers suspected that the Wasque pair, which lost its nest on 9 May, subsequently moved west and nested on Norton Point Beach. This pair is tallied for both sites, but only once in regional and state total counts and numbers of pairs with fledge data.

[p] Observers suspected the pair at Oyster Pond eventually nested at Watcha Pond. This pair is tallied for both sites, but only once in regional and state total counts and numbers of pairs with fledge data.

[q] This site also includes the Lewis property and Long Point Wildlife Refuge.

[r] Coskata-West Beach refers to the beach along the Nantucket Sound side of Coskata, from the south end of The Galls south and west to the boundary of Coatue. This is the same area that was referenced as Coskata-North Beach in 1993 and as part of The Galls in 1991 and 1992. Census data for Great Point, The Galls, and Coskata-West Beach were not reported separately in 1996 or 1997.

[s] Coskata-Inner Trail refers to the inland trail running south and west from Coskata toward Coatue. Coskata-East Beach refers to the beach along the eastern (Atlantic) side of Coskata, including the washover at The Glades. Coskata Inlet is the inlet from Nantucket Harbor into Coskata Pond.

[t] Low Beach/Tom Nevers runs from Siasconset south and west and includes the beach in front of Tom Nevers Head. In 1999, this site was split and reported as two sites: Low Beach/Tom Nevers, and Low Beach-Siasconset.

[u] No plovers nested on the section of Low Beach owned by Nantucket Land Bank in 2001.

[v] The *Unadjusted Total Count* is the sum of the Total Counts reported at each site, not adjusting for potential double-counting.

[w] The *Unadjusted total pairs with fledge data* is the sum of the values reported at each site, not adjusting for potential double-counting.

[x] The *Adjusted Total Count* is the midpoint between the *Index Count* and the *Unadjusted Total Count*, rounded to the nearest whole number of pairs.

[y] The *Adjusted total pairs with fledge data* is calculated by multiplying the Unadjusted total pairs with fledge data by the ratio of the Adjusted Total Count to the Unadjusted Total Count, and rounding to the nearest whole number of pairs.

Table 2. Comparison of Piping Plover nest success in Massachusetts, 2001, with and without predator exclosures.

Fate of nests	Number of nests (%)[a]	
	With exclosure	Without exclosure
Successful[b]	288 (75)	80 (41)
Unsuccessful	96 (25)	114 (59)
Total	**384 (100)**	**194 (100)**

[a] Not included in this table are 15 nests lost to flooding (6 exclosed, 9 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.

[b] Nests were considered successful if they hatched ≥ 1 egg.

Table 3. Comparison of Piping Plover hatching success in Massachusetts, 2001, with and without predator exclosures.

Fate of eggs	Number of eggs (%)[a]	
	With exclosure	Without exclosure
Hatched	1021 (71)	231 (40)
Depredated/failed	416 (29)	350 (60)
Total	**1437 (100)**	**581 (100)**

[a] Not included in this table are 50 eggs lost to flooding (24 exclosed, 26 unexclosed) that presumably would have been lost regardless of whether or not exclosures were used.

Table 4. Reported causes of Piping Plover nest failures (n = 225) in Massachusetts, 2001.

Cause of nest failure	Number of nests		
	With exclosure	Without exclosure	Total
Abandonment	73	7	80
Unknown predator	6	60	66
Overwash/flooding	6	9	15
Crow	2	12	14
Skunk	3	4	7
Fox	2	4	6
Gull	0	6	6
Coyote	0	5	5
Vandalism	2	0	2
American Oystercatcher	0	1	1
Other [a]	6	0	6
Unknown	2	15	17
Total	**102**	**123**	**225**

[a] 6 exclosed nests lost to "other" causes were believed lost to either skunk or fox.

Table 5. Suspected causes of Piping Plover nest abandonments (n = 80) in Massachusetts, 2001.

Cause of nest abandonment	Number of nests		
	With exclosure	Without exclosure	Total
Unknown	26	4	30
Adult killed/died[a]	22	2	24
Predator harassment[b]	8	0	8
Severe inclement weather[c]	3	0	3
Human disturbance/ harassment	3	0	3
Territorial dispute with other PIPL pair	3	0	3
Non-predator disturbance[d]	2	0	2
Exclosure installation	2	0	2
Multiple causes[e]	4	1	5
Total	**73**	**7**	**80**

[a] "Adult killed/died" included 18 nests (17 exclosed, 1 unexclosed) for which adult mortality was confirmed (at one nest, both adults were killed), and 6 nests (5 exclosed, 1 unexclosed) for which adult mortality was suspected. Excluded is 1 other nest at which 1 adult was killed, but the nest was not abandoned by the surviving mate.

[b] "Predator harassment" included harassment by crow (4 nests), gull (3 nests), and canid (1 nest).

[c] "Severe inclement weather" included strong winds, heavy rain, and high tides.

[d] "Non-predator disturbance" included disturbance by a Black Duck and a washed-up boat.

[e] "Multiple causes" included: gulls and/or inclement weather (1 unexclosed nest); crows and/or exclosure design and/or inclement weather (1 exclosed nest); crows and/or exclosure design (1 exclosed nest); exclosure design and/or hay bales placed on beach (1 exclosed nest); and exclosure installation or Northern Harrier presence (1 exclosed nest). "Exclosure design" refers to exclosures constructed of chicken wire (2-inch hexagonal mesh), which may have impeded passage of adults through exclosure.

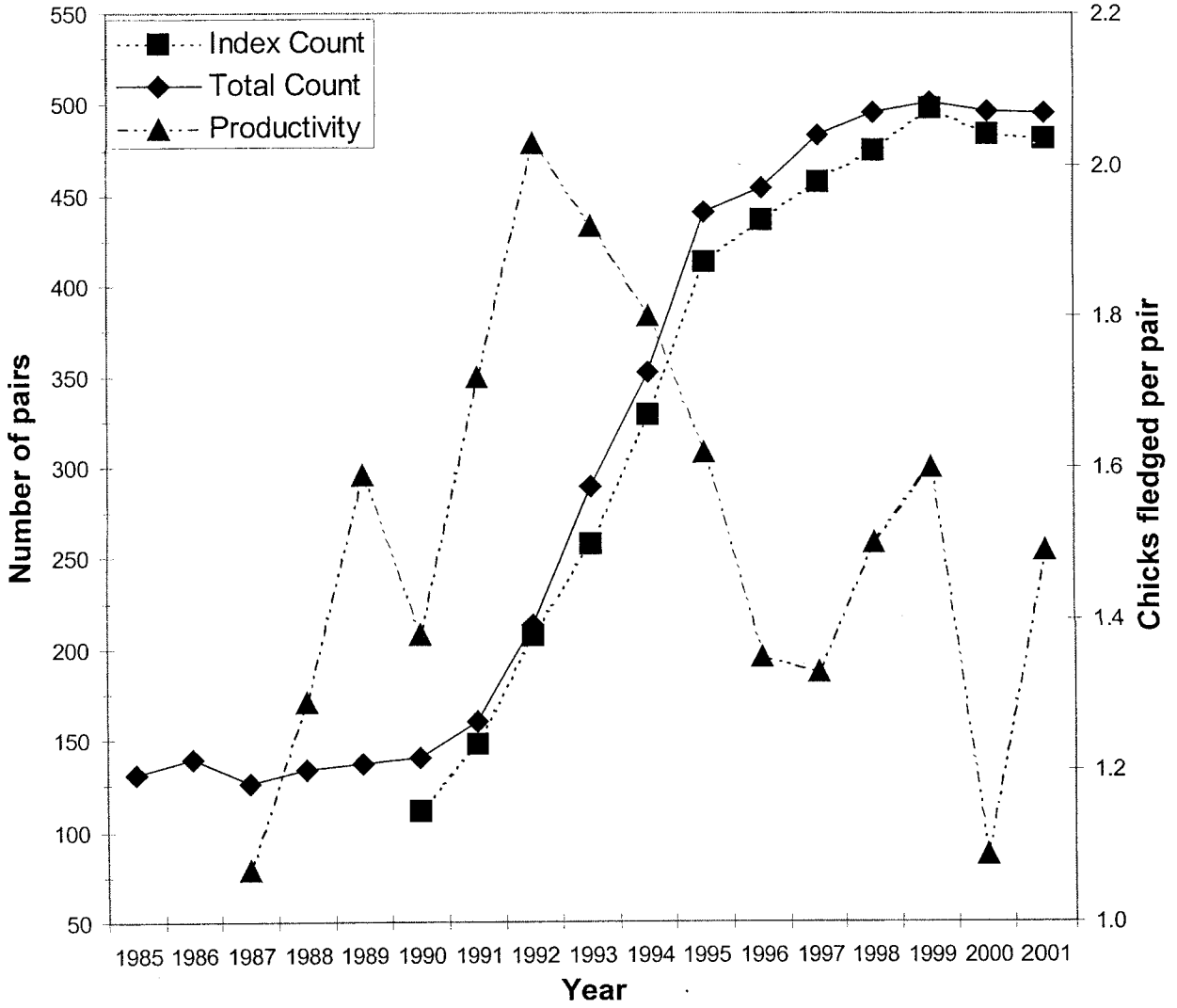

Figure 1. Abundance and productivity of Piping Plovers in Massachusetts, 1985-2001. In 2000 and 2001, the total number of pairs is the Adjusted Total Count, and productivity is based on the Adjusted number of pairs with fledge data.

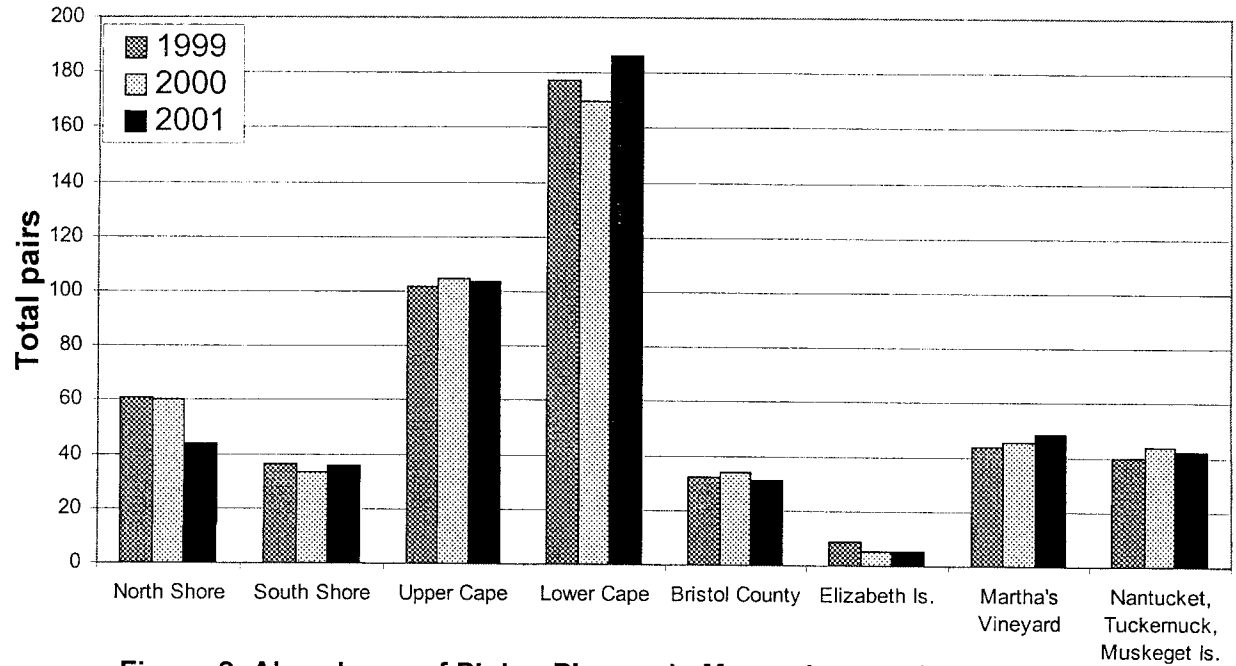

Figure 2. Abundance of Piping Plovers in Massachusetts by region, 1999-2001. In 2000 and 2001, the values are the Adjusted Total Counts for each region.

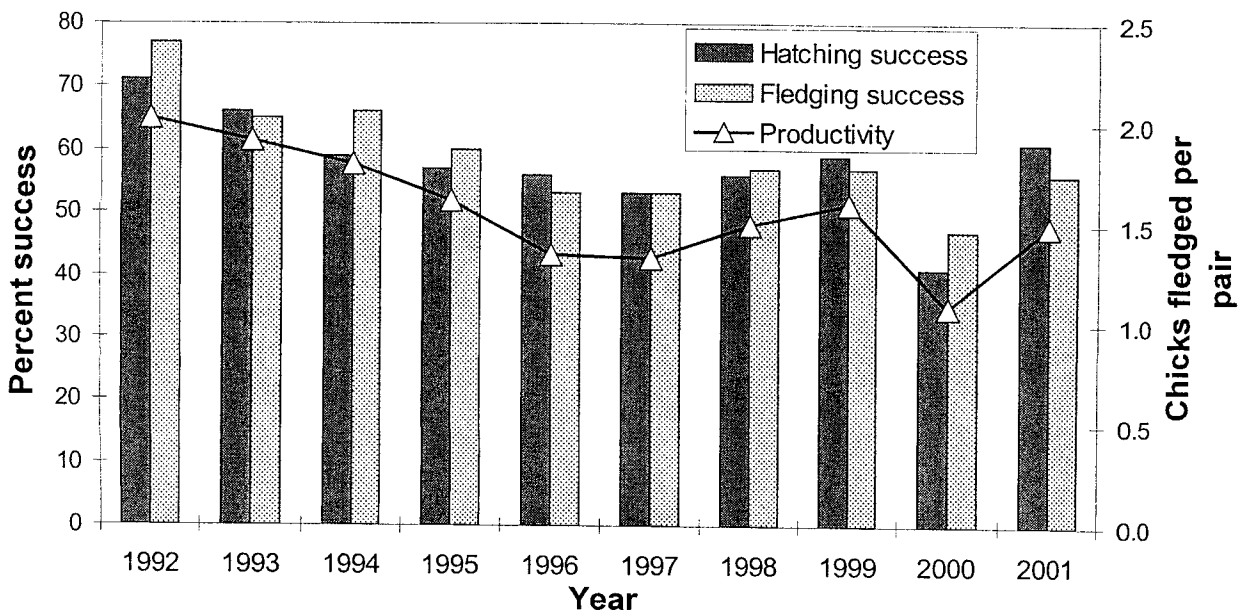

Figure 3. Hatching success, fledging success, and productivity of Piping Plovers in Massachusetts, 1992-2001. In 2000 and 2001, productivity was based on the Adjusted number of pairs with fledge data.

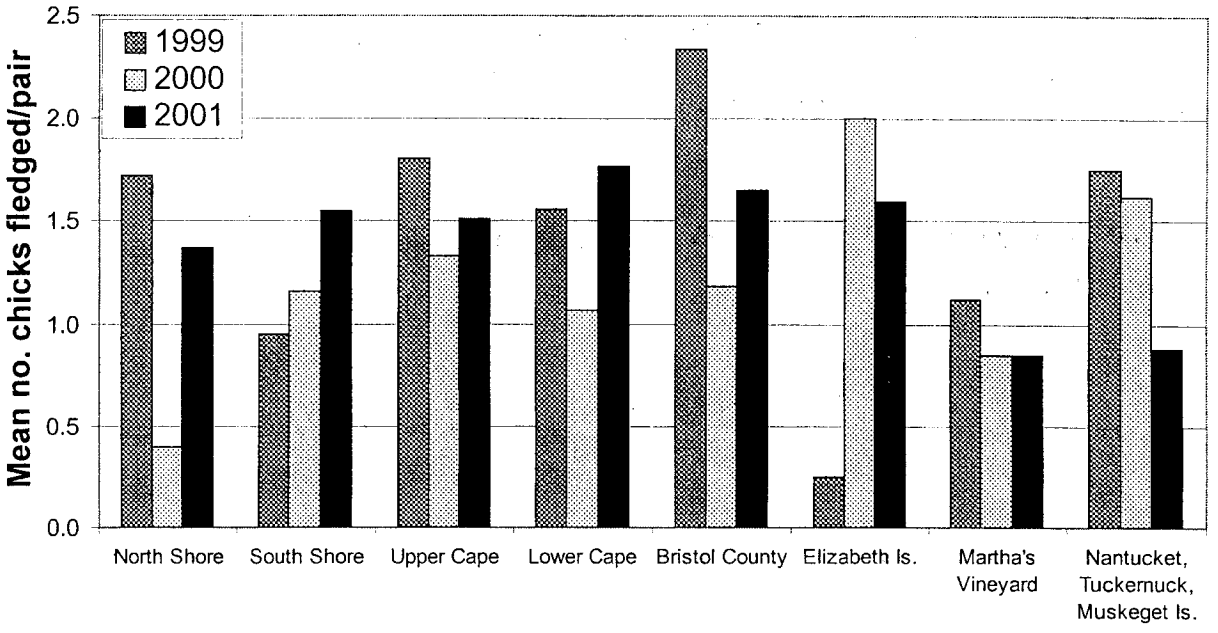

Figure 4. Productivity of Piping Plovers in Massachusetts by region, 1999-2001. In 2000 and 2001, productivity was based on the Adjusted number of pairs with fledge data for each region.

http://www.state.ma.us/dfwele/dfw/nhesp/nhcensus.htm

* mass wildlife.com

Electronic forms for This Years Data

http://pipingplover.fws.gov

EGR

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were PRs counted in ptal also tallied in Index Ct? back data
double check records of prt.

PRs 14 + 15 (and others that disappeared) indicate prob. moved elsewhere in data sheet. Check dates

PPL
Crane Beach
Parker River
Springhill?

1.25 ideal PPL

check South Beach

* 2001 1.45
* 2002 ↓

Array → confidence for results

high to low

check fledge info / why so few Array nesting outside cage? disturbance

MA PPL

SOC index
565 total
508 fledged
127 unfledged ~1 one!

*SAP

oilspill

great crab

banned

POST ↓ 14% [down ~20% 2001]
TE ↓ 6%
NE ↓ 18%